REMARKS

Claims 1-34 are pending in the application.

Claims 11, 12 16, 23, 26 and 27 are considered to contain allowable subject matter.

Claims 1-2, 10, 13-15, 17-18, 21-22, 29 and 32-34 are rejected as being anticipated by the newly cited reference to Van Der Zwan, et al., U.S. 7,489,791 ('791). Claim 1 is the main independent claim of this application and all of the other claims depend directly or ultimately from it.

Claim 1 has been amended in two respects. The first is to more clearly recite that the feedback circuit with a low pass frequency transfer function that is integrated on the substrate couples a signal from the output terminal to the first signal input terminal. This amendment alone serves to more clearly distinguish the invention over the newly cited '791 patent. The second amendment is made to clearly distinguish over a newly discovered reference D4 cited in a recent action from the European Patent Office (EPO) in the corresponding EPO application. The EPO action was made of record in the Supplemental Information Disclosure Statement filed on July 3, 2009. Applicant first shows that the claims patentably distinguish over the '791 reference.

The purpose of '791 is to supply a bias current to the gate of a JFET (2 of Fig. l) that is used as a preamplifier for a microphone ('791 Abstract). The '791 patent discusses the prior art (Fig. 1) as accomplishing this with a separate circuit that uses four components. The purpose of '791 is to provide the bias for the JFET using feedback from a sigma-delta analog to digital (A/D) converter (9).

Main claim 1 of the application recites a microphone preamplifier having a semiconductor substrate on which is integrated a differential amplifier. The differential amplifier has:

a first signal input terminal,

a second input terminal that is to send the audio input signal from the microphone,

an output terminal; and

a feedback circuit integrated on the substrate that has a low-pass frequency transfer function to couple the signal from the output terminal to the first signal input terminal.

Applicant respectfully submits that the '791 reference has not been properly interpreted by the Examiner and is of limited relevance to the claimed invention. The Examiner apparently fails to correctly discriminate between the depicted circuit blocks, or limitations, of the '791 disclosed sigma-delta A/D converter of Fig. 4 and those of the JFET microphone preamplifier of Fig. 1 as they are coupled to the sigma-delta A/D converter.

In applying the '791 reference the Examiner does not focus on the JFET (2) that receives the signal from the microphone (1). Instead, he refers to the differential amplifier A_{COM} of the '791 sigma-delta A/D converter 9 and totally disregards the JFET, which really more closely corresponds to the differential amplifier of claim 1 in which a part of the input signal from the microphone applied to the differential amplifier second input terminal for amplification is fed back from the amplifier output stage to the amplifier first input terminal.

To explain, Fig 4 of '791 discloses a microphone 1 and its preamplifier 2 in circuit block 3. This is coupled to a first order sigma-delta A/D converter or modulator which includes all residual circuit blocks, i.e., items 9, 5, 7, 8 and $G_2(z)$ LPF. Reference is made to column 4, line 12 of '791 that compares Fig 4 with the corresponding schematic diagram of the first order sigma-delta A/D converter described in Fig. 3 The output of the first order sigma-delta A/D converter is a digital data stream as indicated by the marking "DATA".

Circuit block 9 of '791 is a differential integrator ('791 column 4, line 13) which forms part of the first order sigma-delta A/D converter. The differential integrator includes the common-mode amplifier A_{COM} as described in column 5, lines 25-26 of '791. The common-mode amplifier is discussed below.

In '791, Fig. 4, the (very simple) microphone preamplifier is constituted by the single JFET transistor 2. This JFET transistor 2 has only a single signal input terminal, which is the gate electrode of the JFET transistor 2. The JFET gate has a resistor R_{BIAS} connected to ground. The JFET gate receives a microphone input signal from a microphone transducer 1. Accordingly, the '791 microphone preamplifier 2 does not correspond to a differential amplifier with an input stage

comprising first and second signal input terminals as set forth in pending claim 1 of the subject application. On the contrary, the input stage of the microphone preamplifier 2 in Fig. 4 of '791 is, so-called, single-ended as opposed to differential as in the present invention.

It follows that no feedback signal could be applied to a second signal input terminal of the '791 microphone preamplifier 2 simply because such a second signal input terminal does not exist on the '791 microphone preamplifier as shown.

With regard to the Examiner's interpretation of the common-mode amplifier A_{COM} of '791 as being a microphone preamplifier, applicant respectfully submits that it is notoriously well known in the art that the term "common-mode amplifier" means an amplifier used for DC bias-setting purposes alone as opposed to AC signal amplification purposes. This is in marked contrast to the differential amplifier used on microphone preamplifiers. Common-mode amplifiers are deliberately designed to be entirely insensitive to AC signals such as microphone audio signals. A common-mode amplifier suppresses AC signals, and only responds to the DC voltage at its inputs.

Accordingly, the '791 common-mode amplifier A_{COM} of Fig. 4 cannot serve to amplify a microphone signal. The purpose of the common-mode amplifier A_{COM} is solely to set appropriate DC bias points at those internal circuit nodes of the '791 integrator circuit 9 that are coupled to the respective drains of transistors M1 and M2.

Furthermore, in '791, the output terminal of the common-mode amplifier A_{COM} is not coupled to a second signal input terminal of the microphone preamplifier 2 through a feedback circuit having a low pass frequency transfer function as claimed in the present invention. In '791, Fig 4, the feedback signal to the JFET (see Fig. 3, signal node) is the AC and DC components of the digitized (DATA) signal (5) that are produced by the two digital to analog converters (7 and 8).

The '791 microphone preamplifier 2 does not include any second signal input terminal that could be used to receive a feedback signal through the illustrated feedback circuit or path, $G_2(z)$ PF, as explained above.

Accordingly, main claim 1 sets forth a novel and advantageous circuit that is neither shown nor suggested by the '791 reference. Therefore, this claim is patentable and should be allowed.

As to the other claims of the application rejected as being anticipated by the '791 reference or obvious over it, these rejections also fail since these claims all depend directly or ultimately from claim 1. Therefore, these claims are patentable and should be allowed.

Claims 3-4, 5-7, 19 and 30 and 24 are rejected over the '791 reference in combination with a secondary reference. The secondary reference, even if it can be properly combined with the '791 reference, does not cure the basic defect of the '791 reference in rendering claim 1 obvious. Therefore, these claims also are patentable and should be allowed.

Applicant refers to the Supplemental IDS filed on July 3, 2009 and reference D4 titled *Operational Amplifier Applications for Audio Systems* by Losmandy. D4 broadly discloses, in Fig. 5, a prior art feedback coupled microphone preamplifier wherein the feedback circuit has a low-pass frequency transfer function. However, D4 fails to disclose the following novel features of amended clam 1:

1) a feedback circuit with a low-pass frequency transfer function integrated together with a microphone preamplifier on the same semiconductor substrate;

2) the feedback circuit configured with an active device which provides an ohmic impedance across a two-port circuit. This feature is added from claim 10, which has been cancelled.

The present invention as set forth in amended claim 1 has markedly improved on the basic preamplifier of D4.

Starting out from D4, the technical problem addressed and solved by the present invention is in providing an improved microphone preamplifier circuit with lower semiconductor substrate area consumption and without any need for external components (components not integrated on the substrate with the amplifier) as would normally be required by D4. This allows a microphone preamplifier to be manufactured at a very lost cost in very high volumes thereby providing significant commercial advantages.

This problem has been solved by the present invention by the integration of the feedback circuit having the active device of 2) above with a low-pass frequency transfer function on the semiconductor substrate together with the microphone preamplifier without excessive consumption of semiconductor substrate or chip area. This objective problem is discussed in [0008] of the publication document 2007/0076804 of this application.

The skilled person, setting out from Fig. 5 of D4 is taught to use a capacitor of 15 μF as part of a feedback circuit with a low-pass frequency transfer function. Integrating a 15 μF-sized capacitor on a semiconductor substrate, in particular a low-cost semiconductor substrate, is disadvantageous due to the excessive semiconductor substrate area required to provide capacitors of large value. The manufacturing costs of a semiconductor substrate, or chip, is directly proportional with its area. A skilled person looking at Fig 5 of D4 would consider the 15 μF capacitor to be a component external to the semiconductor substrate if the amplifier itself is on a substrate. Nothing in D4 would prompt or motivate the skilled person to seek to integrate on a semiconductor substrate the disclosed feedback circuit of Fig. 5 of D4 with a low-pass frequency transfer function in a microphone preamplifier targeted for low-cost telecommunication microphones.

In accordance with applicant's invention, as claimed in amended independent claim 1, the technical problems associated with providing a commercially viable microphone preamplifier have been overcome by the inclusion of features 1) and 2), i.e. a feedback circuit with a low-pass frequency transfer function and configured with an active device which provides an ohmic impedance across a two-port circuit (original claim 10).

As to feature 2), the active device providing the ohmic impedance makes it possible to integrate all components of the feedback circuit with a low-pass frequency transfer function on the semiconductor substrate.

In a preferred embodiment of the present invention disclosed in Fig. 5c), an active device, in the form of triode-coupled MOS transistor 516. This has a very high ohmic resistance which makes it possible to implement feedback in the audible range by a pair of very small pF-sized (pico-forad) feedback capacitors C1 and C2 occupying only a small semiconductor substrate area. See [0080] – [0094] of the application publication. An appropriate low-pass cut-off frequency, for example between 1 - 100 Hz, is set by the interaction between the active device having a high

resistance value according to feature 2) and the small value feedback capacitors. This overcomes the need for excessive semiconductor chip area consumption and its associated unacceptable cost penalty.

Consequently, features 1) and 2) of amended clam 1 cooperate to provide a low-cost microphone preamplifier which can provide the desirable high-frequency transfer function without resorting to the use of external components, in particular external capacitors.

Therefore, for the reasons given above, claim 1 also patentably distinguishes over the EPO application D4 reference. Since all of the other claims depend directly or ultimately from claim 1, they also are patentable and should be allowed.

Prompt and favorable action is requested by the allowance of the claims and passage of the application to issue.

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Respectfully submitted,

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